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SUPPORT FOR THE INCLUSION OF PERSONAL VALUE PREFERENCES IN DECISION SUPPORT SYSTEMS

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ABSTRACT

We consider the important issue of including personal value preferences in decision support systems (DSS). Various personal differences have been shown to affect the acceptance, use, and effectiveness of DSS. Decision-making models offer a theoretical basis for the inclusion of various personal differences (including personal value preferences) in decision-making. Research in the field of psychology has long recognized the importance of values in both motivation and choice behavior. Other research has also found personal values to be relevant in decision-making. We posit that since personal values are important in the decision-making process, they should also be important in the support of decision-making and thus in decision support systems.

KEY WORDS: *personal values, value types, decision, decision model, decision making, decision support systems, user expectations*

DATA AVAILABILITY: *please contact authors*

SUPPORT FOR THE INCLUSION OF PERSONAL VALUE PREFERENCES IN DECISION SUPPORT SYSTEMS

Introduction

We posit that personal values and value types are important in decision-making and therefore should be considered relevant to the study of Decision Support Systems (DSS). We describe this relationship and relevance in detail. For example, a cancer patient may have several options and her personal values may eliminate certain treatments, based on probabilities of success, general health, or age; while others may involve religious values that prohibit certain treatments. Friends of two authors observed strictly kosher religious dietary laws. When their initially prescribed breast cancer medication involved orally ingesting medicine derived from swine, they sought, discovered, and were treated with comparable injection treatments.

This paper is organized as follows: First, literature related to various personal differences and DSS is briefly reviewed. Second, personal difference psychology, the importance of values to human choice behavior, and research regarding values and value types are discussed. Third, we

discuss decision-making models followed by sections describing individual difference psychology, values and personal values, and decision-making. Fourth, in the final section, we provide a detailed discussion which includes our conclusion.

Personal Differences and Decision Support Systems

The relationship between the field of personal difference psychology and Decision Support Systems (DSS) is not directly addressed in the literature. However, a relationship between this field of study and decision support systems can strongly be inferred from the importance given in the literature to various factors that can be considered personal trait related: (1) intuition, (2) cultural differences, (3) problem solving modes, (4) cognitive style, (5) human factors, and (6) personality type. We review each of these in turn.

Intuition

Little (1970) indicated that in order for management science models to be useful, they must be used. Instead of designing models for the “technical people,” they should be personalized to the user. “The model is meant to be a vehicle through which a manager can express his views about the operations under his control ... the whole process might be described as an updating of his intuition.” Sauter (1999) describes six forms of intuition (illumination, detection, evaluation, prediction, operative, and creative) and their implications for decision support systems. These implications include virtual experience, tracking experience, data mining, tools for analysis, and presentation.

Intuition is improved by experience. By enabling managers to have virtual experience and track their own experiences, a DSS can encourage intuition. In addition, intuition is facilitated by the availability of data mining for scanning of relevant data, tools that ease the identification, summarization, and analysis of data, and presentation modes that illuminate trends (Sauter, 1999). An interesting suggestion by Sauter (1999) to improve the intuitive support of DSS is the development of private databases. These secure databases could be used to store decision-maker specific information: ethics, values, goals, plans, past experiences, etc. “Allowing DSS users to enter this information into the system or allowing the system to deduce relevant factors based on past decisions could facilitate intuition” (Sauter, 1999). In general, some active form of artificial intelligence would be necessary for the latter to work successfully.

The importance of combining intuition with decision support models was addressed by Blattburg and Hoch (1990). They compared the results of five different business forecasts made by managers without model support, made by the model without manager input (intuition), and business forecasts made with a combination of manager intuition and the model. The results indicated that the combination of the model and the manager’s intuition improved performance by about 16%. Additional evidence of the importance of intuition to DSS was found as a byproduct of a study by Lu, Yu and Lu (2001) of the acceptance of the three different DSSs based on cognitive style. While the results for cognitive style differences were mixed (the acceptance of only one of the three DSSs was found to be based on cognitive style), there was a significant indication

regarding trust. When given a choice among the decision results of the three models and intuition, the subjects (MIS graduate students) picked the intuitive decision approximately 90% of the time. There are instances when a decision needs to be made quickly without the benefit of adequate planning, funding or information. Turban, Aronson, Liang and Sharda (2007) refer to this type of intuitive decision-making as decision making from the gut:

Many analysts and reporters characterize this gut-based decision-making process as the brilliance of a leader who quickly synthesizes situational information from his analysts to make an informed decision, while others attribute this behavior to a lack of understanding of the facts and analysis, possibly based on laziness.

By contrast, Sadler-Smith and Shefy (2004) argue that intuition is an integral part in the executive decision-making processes. They propose an integrated approach where “intuition and rationality are complementary to the extent that executives need to be able to learn how to use each to fit the demands of particular decision-making situations.” This study also provides a series of guidelines that acknowledge the limitations in the use of intuition while emphasizing the effective and intelligent use of it. Executives are therefore required to expand their repertoire of skills and strategies beyond rational analysis and include intuitive judgment possibly through training and coaching. Intuition should be regarded as a natural and frequent component in decision-making. When explained and managed effectively, intuitive intelligence can help managers make both fast and accurate decisions in the constantly changing business environments (see also Hodgkinson, Langen-Fox, & Sadler-Smith, 2008; and Hodgkinson, Sadler-Smith, Burke, Claxton, & Sparrow, 2009). The enhanced speed and accuracy in the decision-maker’s abilities are also attributed to intuitive intelligence in the work of Dane and Pratt (2007) and Miller and Ireland (2005). The Dane and Pratt (2007) study defines the conditions for using intuition in decision-making. They state that accurate intuitive judgments can only be generated by an executive who is an expert in that specific field or industry from which the cognitive schemas were developed. In turn, this argument limits the transferability of intuitive skills across fields and industries. Apart from strategic decisions, the allure of intuitive decision-making and its constraints is also observed in using moral intuition and ethical decision-making (Sonenshein, 2007).

Cultural Differences

Tai and Phelps (2000) compared the perceptions of Hong Kong CEO’s and CIO’s with respect to their vision of information technology (IT), the importance placed on IT issues, their acceptance of IT for knowledge management, and the effect of CEO/CIO relationships. In addition, the study included CEO’s and CIO’s from both Western and Chinese firms. It was hypothesized that there would be a perceptible gap between IT perceptions of CEO’s and CIO’s based on national culture, type of industry, and management relationship. Contrary to prior research, their “...study suggests that overall there is no significant difference between CEO and CIO perceptions of IT visions, organizational IT issues, or the use of IT for KM.” In connection with implementing knowledge management, the respondents from both groups viewed the importance of people, process, and technology the same. In addition, there was some evidence that “...poor CEO/CIO relationships may adversely affect similarity of perceptions.” The main

perception differences identified were culturally oriented. While the Western CEO's and CIO's showed no mean difference in scores, their Chinese counterparts showed "...a significant difference in mean scores for 'vision to transform'... and in rankings..." between the CEO's and CIO's in their perceptions of the role played by Information Technology: that is, whether the role of IT is management information focused (referred as 'informate up') or employee improvement focused (referred to as 'informate down'). "Chinese firm CEO's ranked 'informate up' first and 'informate down' last on the list." Tai and Phelps (2000) indicate that this difference most probably reflects the Chinese view of information as being personally rather than organizationally owned. Also, top Chinese managers maintain control by storing critical information in soft form instead of collectively accessible organizational form. This control-oriented cultural difference can impede the implementation of knowledge management systems.

Therefore, they point out that the personal trait of "power" may possibly have cultural implications. This potential cultural difference could apply not only to the acceptance of knowledge management systems, but possibly also to the acceptance and utilization of decision support systems.

A more recent study by Tihanyi, Griffith and Russell (2005) examines cultural distance as a factor in multinational corporations' decisions relating to entry mode choice, level of international diversification and performance. While the effect of cultural distance is not unidirectional throughout the sample, the evidence suggests that cultural distance does interfere in the decision-making process. Similarly, cultural sensitivity is a determining factor when dealing with a foreign trading partner. This factor is crucial in negotiations, expansion decisions and in the training of new buyers (Tihanyi, et al., 2005).

Problem Solving Modes

Wierenga and Van Bruggen (1997) used four problem-solving modes (optimizing, reasoning, analogizing, and creating) to develop an integrated framework with marketing management support systems (MMSSs). Their framework was an attempt "...at transforming decision situations, through marketing problem solving modes (MPSMs), into requirements for decision support. By doing so, the MMSS that fits best with the decision situation can be determined." In discussing the framework, they indicated a belief "...that managers will be inclined to use only MMSSs that match with the MPSM they use" (Wierenga & Van Bruggen, 1997).

The relationship between decision support systems and problem solving modes was expanded by Van Bruggen and Wierenga (2001) in their study of the demand for Management Support Systems (MSS, i.e., DSS) and the supply of appropriate support systems. "The premise of this study is that in order to be successful, Management Support Systems (MSS) should match the thinking and reasoning processes of managers." The supply should match the demand. The supply side factors were identified as composed of 44 MSSs in the field of marketing divided, based on like characteristics, into eight Marketing Management Support Systems (MMSS). The demand side factors were identified as composed of four problem-solving modes used by managers in decision-making.

The results of this study indicate that there is often a mismatch between the supply of MMSSs and the problem-solving mode. It was found that a match existed between the demand for support and the support actually offered in only thirteen cases out of a total of thirty-four situations for which data were available. In comparison with bad matches, good matches between the decision-making mode and the MMSS characteristics result in greater user satisfaction, a greater impact on decision making, and higher company implementation and retention of the system.

Cognitive Style

The importance of considering cognitive style when designing a DSS has been a topic of debate for over thirty years. In 1980 Sprague referenced the idea of using cognitive style when he suggested using "...a DSS in a way that reveals what managers can and should receive from an information system. For example, one of Scott Morton's early suggestions was that the system be designed to capture and track the steps taken by managers in the process of making key decisions..." Benbasat and Taylor (1982) specifically referenced cognitive style in the design of management information systems:

Systematic (and thinking) decisionmaker types would prefer decision aids and reporting systems which are quantitative in nature with results supported by mathematical formulas. Intuitive decisionmakers would require more data search capabilities prior to reaching decisions... The information system should give them capabilities to try alternative solutions and analyze the possible outcomes before they decide on their final approach to solving the problem.

Huber's (1983) study reached two conclusions that questioned the use of cognitive style in the design of DSSs: "...[first] the currently available literature on cognitive styles is an unsatisfactory basis for deriving operational guidelines for MIS and DSS designs. ...[and second], further cognitive style research is unlikely to lead to operational guidelines for MIS and DSS designs." He went on to state the following:

Whether the user's numerical score on a marginally predictive cognitive style assessment instrument would be of much value to either the user or the designer/consultant seems highly problematic. Instead, it seems that task considerations and the user's expressed preferences for specific DSS features should be the factors that determine the DSS design.

Despite Huber's concern about the use of cognitive style research in developing guidelines for DSS design, research into this area continued. A study by Van Bruggen, Smidts and Wierenga (1998) compared the benefits derived from a Marketing Decision Support System (MDSS) based on cognitive style as measured along the dimensions of low-analytical and high-analytical. The results of their laboratory experiment indicated that the high-analytical decision-makers generally outperformed the low-analytical decision-makers. The high analytic types showed more variation in their decisions, showed a greater ability to identify key variables, and made better decisions. However, the low-analytical decision-makers did make better decisions with the aid of the MDSS than without it – an implication that "...in companies low-analytical decision-makers should also be provided with these systems and convinced of their usefulness."

Barkhi (2002), in a study of cognitive style related to communication mode, referenced six research studies related to cognitive style and decision-making between 1986 and 1999. He concluded that "...there is evidence that [cognitive style] explains decision choices, preferences, and perceptions." Prior literature has documented the significant effect of cognitive style on group decision-making. Franco and Meadows (2007) extend the analysis and examine the impact of cognitive style on the problem structuring methods (PSMs). The study identifies and explores the role of four different cognitive style functions in problem structuring interventions. From another perspective, Armstrong and Hird (2009) examine the relation between cognitive style and entrepreneurial drive. Their empirical evidence suggests that entrepreneurs tend to be more intuitive and less analytic than non-entrepreneurs. In addition, more intuitive entrepreneurs display higher levels of entrepreneurial drive which implies that intuition and cognitive style can predict successful entrepreneurs and therefore better decision makers.

Human Factors

Due to the increase in competition problems in the mature legal market, the European Union funded trials of a new Legal Support System (LSS) in three London law firms. Hayman and Elliman (2000) present a case study of the problems encountered in the implementation of a LSS in one of the law firms. This system aimed at reducing many of the tedious manual functions encountered in storing, retrieving, recording, copying, analyzing, and preserving the chain of evidence of legal documents. The new "...system design sought to provide support for browsing and concept formation by including optical character recognition and free text retrieval interfaces within the system." Document management was to be improved by use of encoding-methods and full-text search methods and by elimination of filing and copying. However, the LSS system design did not adequately address the human factors of these knowledge workers. While it did automate processes, it did not provide the needed holistic approach to core and informing activities.

Because of the perceived need to be accountable and control the evidence, the Solicitor (an attorney who advises clients on legal matters, represents clients in certain lower courts, and prepares cases for barristers to present in the higher courts) did not trust the biographical coding by subordinates and stopped using juniors for research (he accessed the system directly). This resulted in his doing many menial tasks and becoming insulated from his support staff. Consequently, the juniors lost track of the progress of the case. In addition, while the automated system was used for document retrieval, it was not used for idea exploration and generation. The knowledge work was performed by skimming and reading the hard copies maintained in binders. As stated by Hayman and Elliman (2000), "the system's intent, to remove some of the apparently tedious document handling tasks, was counter productive as it inhibited the Solicitor in becoming familiar with the breadth and richness of the documentation." This case study points out the need for the computerized support system to support certain human factors in order to be accepted and used. These factors include accommodating individual differences in knowledge acquisition (core and informing activities), the reliance on and acceptance of the work of fellow employees, and the sharing of information. These three factors could also be associated with the individual differences of cognition, trust, and power.

Prior research (e.g., see Turban, et al., 2007) suggests that when a new information system is developed or an existing one is modified, user involvement and user training are critical to its use and ultimately its success. It is through user involvement in the development process that the actual work processes (including the human factors) are analyzed and understood and improved upon by the development team.

Personality Type

The Swiss psychologist Carl G. Jung theorized that a person's mental habits could be described by three psychological dimensions: energy, perceiving, and evaluation. Each of these three dimensions is bipolar. Energy is divided into extraversion and introversion; perceiving is divided into sensing and intuition; and, evaluation is divided into thinking and feeling. These theorized dimensions were later operationalized by the Myers-Briggs Type Indicator (Pearman & Albritton, 1997). Mason and Mitroff (1973) point out that in the Jungian System most individuals adopt "...a preference for one mode of perceiving (sensation or intuition), and one mode of evaluation (thinking or feeling). The alternative modes remain, as a result, undeveloped or unconscious." The individual's preference for a perceiving mode affects the type of information favored by that individual: sensing types favor sensory data while the intuition types favor abstract data. The individual's preference for an evaluation mode affects the individual's preference for a decision or judgment mode: Thinking types favor cause-and-effect type analysis while feeling types favor decisions based on personal values (Pearman & Albritton, 1997).

Therefore, both the information preferred by a decision-maker and the decision mode is related to that individual's psychological type. According to Masson and Mitroff (1973),

What is information for one type will definitely not be information for another. Thus, ...designers of MIS [should not force] all types to conform to one [type of information], but ...give each type the kind of information he is psychologically attuned to and will use most effectively.

Managers' personality and their ability to influence others do affect their success in decision-making (Yukl, 1998). This is a crucial factor since managers who use pressure and persistence may influence the decision process differently than managers who arrive at decisions through constructive cooperation. Cable and Judge (2003) examine the theoretical linkages between the five-factor model of personality and managers' influence tactic strategies. The study concludes that extravert managers are more likely to use inspirational appeal and ingratiation while agreeable managers are less likely to use pressure and hard influence tactics.

The results also suggest that, while controlling for personality traits, managers choices of upward influence tactics is determined by the leadership styles. Therefore, "Managers were more likely to use consultation and inspirational appeal tactics when their supervisor was a transformational leader, but were more likely to use exchange, coalition, legitimization, and pressure tactics when their supervisor displayed a laissez-faire leadership style" (Cable & Judge, 2003). From another perspective, the study reveals that certain personality traits are common in certain job types regardless of an individual character. For example, marketing managers are more

likely to employ soft inspirational influence tactics, while finance and accounting managers are more inclined to use pressure and hard influence tactics (Cable & Judge, 2003).

In a more recent paper on the role of personal values, Illies and Reither-Palmon (2008) establish an effect of personal values on destructive leader behavior. They defined destructive behavior as a pursuit of short-term, non-value maximizing, decisions. The empirical evidence suggests that managers with self-enhancement values are more likely to make destructive decisions than individuals with self-transcendence values. Therefore, corporate value maximization is not the sole driver of decision-making. Similarly, Hemingway and MacLagan (2004) document an association between the implementation of corporate social responsibility and the various personal values of individual managers. Within the concept of managers' personality, Ivan and Ivana (2012) study provides strong evidence of interdependence between the managers' learning types - incremental and radical learning - and the strategic decision making approaches. Specifically, incremental learning has a stronger effect on analytical decision making than radical learning and consequently the managers' learning types have a significant effect in the strategic decision making outcomes.

Summary of the Personal Differences and the DSS Literature

This brief literature review points out the importance that various factors, that can be considered personal difference related, bear to the acceptance, use, and effectiveness of DSS. Sauter (1999) indicated that there are six forms of intuition, and their implications for DSS. Lu, et al. (2001) indicated a lack of trust in DSS when compared to intuition. Blattburg and Hoch (1990) showed that a combination of DSS and intuition improves results. Tai and Phelps (2000) showed that individual differences related to culture may impede knowledge management system acceptance. Van Bruggen and Wierenga (2001) found a mismatch between the demand for marketing management support systems based on problem solving mode and the supply of support. Van Bruggen, et al. (1998) ascertained a difference in DSS benefit based on cognitive style. The case study of Hayman and Elliman (2000) illustrated the need for a holistic approach to LSS that included support for certain human factors. And, Mason and Mitroff (1973) explained the difference in informational needs based on different psychological types.

Decision-Making Models

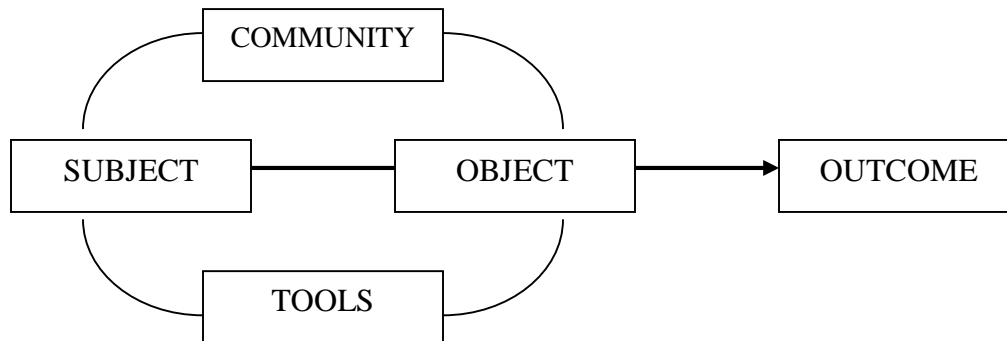
In addition to the literature support for a link between personal differences and decision-making, various decision-making models also posit this connection. We next discuss three models that demonstrate the importance of personal differences in sense-making (the ways that managers make sense of and use knowledge for decision-making), choice of reasoning made, and adoption and capability based on images. These models are the CHAT (Cultural-Historical Activity Theory) model, the ORAC (optimizing, reasoning, analogizing, and creating) model, and the image theory model.

CHAT Model

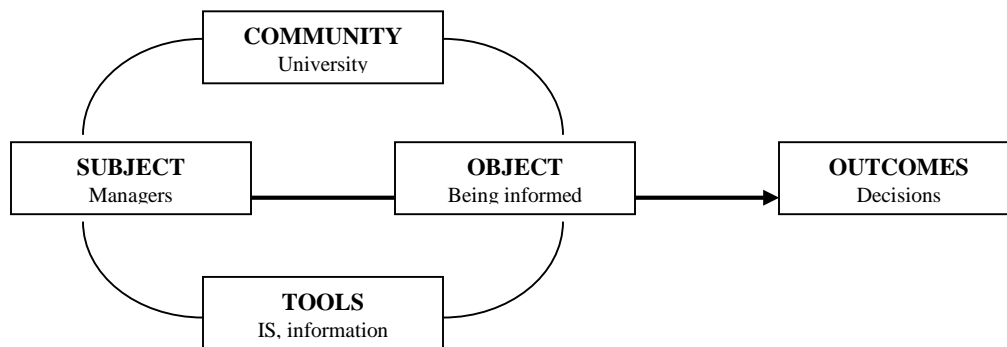
The Cultural-Historical Activity Theory (CHAT) Model (Figure 1) for management support systems recognizes the computer as a tool that mediates decisions and activity. In this model, the sense-making connections between the information supplied by the computerized information system and the actual decision are a cognitive function of the manager (Hasan & Gould, 2001). While traditional decision support research is based on the rational model where a structure exists for finding an optimal solution, most senior management decision-making is not completely rational and is made in an unstructured environment. Such unstructured decisions are usually supported by an organizational information system. A sense-making activity provides the cognitive link between the information and the decision. This sense-making activity is based on "...each manager's perceptions [being] ...colored by experience, values, and motives" (Hasan & Gould, 2001). Hasan and Gould (2001) proposed that the Cultural-Historical Activity Theory (CHAT) provides the appropriate theoretical basis for linking knowledge management support, sense-making, and strategic decision-making. "This theory provides a practical model of what people do, focusing on the relationship between the subject and object of an activity, a relationship mediated by tools and community" (Hasan & Gould, 2001).

FIGURE 1
The CHAT Framework

The CHAT framework of an activity



The CHAT framework applied to the sense-making activity of managers



Adapted from Hasan and Gould (2001)

The CHAT Model recognizes three kinds of tools: primary, secondary, and tertiary. Primary tools are physical in nature and include computers. Secondary and tertiary tools are both psychological tools. Secondary tools include language, signs, ideals and models. Tertiary tools include cultural systems. Both physical and psychological tools are basic to human activity and mediate activity (Hasan & Gould, 2001).

According to Hasan and Gould (2001), "...a most important assumption in a CHAT approach is that all activity is mediated by the use of tools and by the community in which it occurs." The Internal Plan of Action (IPA) is a CHAT concept that relates to the ability of humans to manipulate representations of objects internally before taking actions in reality (Hasan and Gould, 2001). "The computer, which has been described as a cognitive artifact, can be viewed as an extension of the IPA involved in the transmission and manipulation of information" (Hasan and Gould, 2001).

In CHAT, the use of tools mediates human activities. This change in the nature of activity can also create new activities. This characteristic of tool use explains the change in work practices that is often not considered in the development of management support systems (Hasan & Gould, 2001). Therefore, the CHAT decision-making model is concerned not only with the tools provided and used by the decision-maker (data, information, knowledge, and support technology) but also with the three mediating factors of community (environment), subjects (decision-maker) and objects (sense-making activity). All three of these factors are related to personal difference psychology. The subjects have different values, morals, experiences, motives, etc. The sense-making activity relates to the individual differences in cognition. And, the effects of the community are related to behavioral differences that are influenced by nurture and to the pressures to conform to the norms of the society's values (see also Igira & Gregory, 2009).

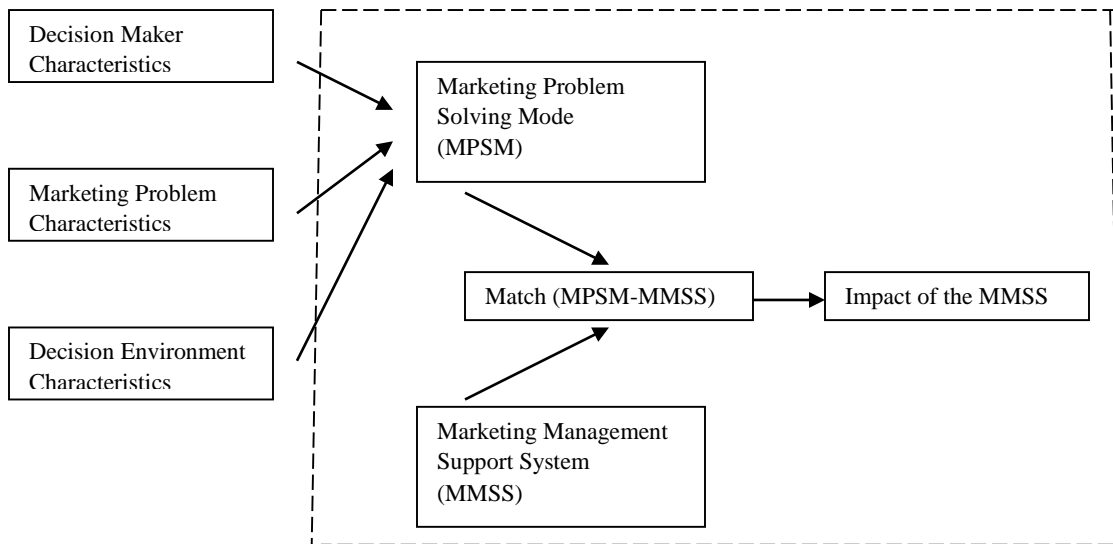
The ORAC Model

According to Van Bruggen and Wierenga (2001) four different problem-solving modes are used by decision-makers. "The specific problem-solving mode that is used depends on the characteristics of the decision-maker, the characteristics of the problem, and the characteristics of the decision environment." These four modes are identified as optimizing, reasoning, analogizing, and creating, the ORAC model (Figure 2).

In the optimizing mode the decision-maker seeks an optimal solution to a problem, often by use of a mathematical model although some problems and their concomitant solutions may be described in terms of qualitative relationships among variables. He/she seeks to find the optimal variable mix that will maximize the goal (Van Bruggen & Wierenga, 2001).

A decision-maker using the reasoning mode constructs a mental model of the problem. With important variables being chosen subjectively, mental models concerning the same decision problem will differ based on the individual characteristics of the decision-maker. Such mental models may be incomplete and may not conform to reality (Van Bruggen & Wierenga, 2001).

Figure 2
The ORAC Model



Adapted from Van Bruggen and Wierenga (2001)

The analogizing mode involves the decision-maker comparing the current decision problem to prior problems and their solutions. Mental reference is made to prior cases about which the decision-maker is knowledgeable. This reference includes recognizing the similarities and differences between the current problem and the historical case (Van Bruggen & Wierenga, 2001). Lastly, in the creating mode, the decision-maker is looking for new ideas. This process often involves thinking about a problem in a different way (outside the box) and formulating and exploring novel and multiple solutions (Van Bruggen & Wierenga, 2001). These four modes may be used independently or together in the decision process. However, the choice of mode and when to use it are driven by the decision-maker, the problem, and the environmental characteristics. Therefore, this model recognizes the personal traits of the decision-maker as one of the “drivers” in the decision process (See Wierenga (2010) for a recent application of the ORAC model).

Image Theory Model

The Image Theory Model (Figure 3), as posited by Mitchell and Beach (1990), includes the key concepts of images, decisions, tests, and frames. Images are of three types: principles, goals, and plans. Decisions are of two types: progress and adoption. Tests include compatibility and profitability. And, frames refer to the circumstances surrounding a decision.

At this step, a decision is made as to whether or not to continue with the current plans and goals. While the progress decision is focused on the “fit” (all or none) of goals and plans with images, the focus of the adoption decision is on profitability. Once more than one member qualifies to be included in the decision set based on compatibility with the three images, the decision-maker must use some strategy to compare the relative merits of each member (Mitchell & Beach, 1990). Mitchell and Beach (1990) define framing as the decision-maker’s ability to use past experience – both successes and failures – as the context for current decision-making. By comparing the current decision problem to similar prior circumstances (problems and their solutions), the decision-maker is able to augment the available data and information. “The theory posits that the context in which decisions occur gives them meaning.”

From the perspective of the Mitchell and Beach’s (1990) Image Theory Model, the focal point of decision-making involves the determination of the “fit” with the images of the decision-maker. If the decision alternatives are not compatible with the individual decision-maker’s value image, goal image, and plan image, it will be rejected. While goals and plans may be changed in the adoption decision phase, the value image is seen as remaining constant. The theory “...states that decision-makers adopt and implement plans to reach goals in order to satisfy principles” (Mitchell & Beach, 1990). Therefore, Image Theory appears to view decision-making as value driven.

Summary of Models

The three decision models, briefly described above, all emphasize the importance of personal traits in decision-making. The CHAT model identifies the personal characteristics of the decision-maker as one of three mediating factors in the use of knowledge, data, information, and technology (Hasen & Gould, 2001). The ORAC model of decision modes emphasizes the importance of the personal characteristics of the decision-maker in the choice of mode (Van Bruggen & Wierenga, 2001). Whereas, the Image Theory Model stresses the importance of the compatibility of the decision set alternatives with the principles, goals and plans of the decision-maker. This theory views decisions as initially values-driven (Mitchell & Beach, 1990).

Individual Difference Psychology and Values

Person-Environment (P-E) Fit Theory posits that human behavior is a function of personal variables (nature), environment variables (nurture), and the interaction of these two variables. In studying person variables, individual difference psychology has traditionally concentrated on the person variable of ability and the two motivational variables of interest and personality traits. However, while ability is a good predictor of performance, the motivational factors only add incremental validity (Dawis, 1999).

Dawis (1999) proposes that personal values be added to abilities, interest, and personality traits as a predictor of behavior. Her nomination of values as an important person variable is made based on evidence indicating a relatively small correlation with and variance overlap with the other three variables. In addition, in stating the importance of values to choice behavior, Dawis (1999)

states that “choice involves judgment, and judgment implies values. Choice may also involve reasoning. Whether we reason from first principles to conclusions or (as we more frequently do) choose our conclusions first then reason back to the appropriate first principles, we choose our conclusions and first principles on the basis of values.”

In addition to the P-E Fit Theory of behavior, attitudes have been studied as indicators of social behavior. Rokeach (1968), however, showed that personal values were better than attitudes as predictors of behavior. He states that “...a value, unlike an attitude, is a standard or yardstick to guide actions, attitudes, comparisons, evaluations, and justification of self and others” (Rokeach, 1968). Rokeach (1968) identified 18 instrumental and 18 terminal values that had a 0.70 test-retest reliability to both behavior and attitudes. These two systems of values were defined by Rokeach as follows:

An instrumental value is ... defined as a single belief which always takes the following form: I believe that such-and-such a mode of conduct (e.g., honesty, courage) is personally and socially preferable in all situations with respect to all objects. A terminal value takes a comparable form: I believe that such-and-such an end-state of existence (e.g., salvation, a world of peace) is personally and socially worth striving for.

Schwartz and Bilsky (1987) expanded the work performed by Rokeach (1968). Based on a smallest space analysis of cross-cultural data collected from subjects in Germany and Israel, they mapped thirty-six values according to eight domains. These domains were then identified as to two levels of interest (individualistic vs. collectivist) and two goals (terminal vs. instrumental). Subsequent work by Schwartz and Sagiv (1995) expanded the theory of the content and structure of human values. In this cross-cultural study of 88 samples from 40 countries, 56 values were tested. The results indicated that the 56 values mapped into ten value types that represented four bipolar dimensions. The instrument they developed – The Schwartz Value Survey – is now “...the most widely used instrument for measuring personal values” (Giacomino & Akers, 1998).

Personal Values and Decision-Making

The personal values of individuals have been shown as related to various aspects of decision-making. The following selected literature review is illustrative of this relationship.

The personal values of American managers seem to be stable over time. In a 1984 study of manager values, Posner and Schmidt (1984) identified over 255 different manager values and traits. The value of integrity tops the list in importance. Posner and Schmidt (1992), in an updated study in which over 1,000 managers responded to a values survey, found that the value of integrity was still the number one value followed by competence. They stated that “managers today, like their colleagues surveyed a decade ago, hold in highest regard people who are seen as honest, and competent” (Posner & Schmidt, 1992). In addition to the stability of manager values, Posner and Schmidt (1992) indicated their perceived importance of values to management decision-making. They stated that “...values determine which facts we examine with care and which we pass over; which options for action we look upon with favor from the start and which we reject out of hand.” This indicates that values directly influence the emphasis that a manager places on the factors involved in the decision and the decision-making process.

Oliver (1999) studied the personal value structure of corporate managers over three decades. He found that the structure of values indicated by value groupings had not changed over the thirty-year period. In addition, the study found support for differences between personal and corporate value systems. He stated that “if this suggestion is correct, there is evidence to support expectation of different decision-making paradigms between personal and corporate environments.”

Dunbar, Saiz, Stela and Saez (2000) used the Schwartz Values Survey (Schwartz & Sagiv, 1995) to study in-group/out-group bias. They found that the perceived difference in values between two groups were predictive of negative stereotyping. Therefore, a perception of value difference between groups can predict decisions relating to bias and stereotyping.

The relationship between work values and decision-making was studied by Ravlin and Meglino (1981). They compared the values of 103 undergraduate students using four different values measurements to the results of twenty work-related decisions. The result indicated that the subjects made decisions that were in agreement with their values. They stated that “values were also found to be a guide or standard for decision-making. In addition to its theoretical significance, this finding has profound implications for organizations that desire decisions to be reflective of particular patterns of values.”

Korsgaard, Meglino and Lester (1996) investigated the relationship between the value “concern for others” and decision-making. Their study “...indicated that individuals high in concern for others were less attracted to the payoffs of various decision options and were less discerning about different payoffs and risks associated with these options.” They theorized that this value difference may be predictive of decision-making and stated that “...these findings suggest that concern for others may predict basic differences in a variety of judgment and decision-making situations.”

Values that are traditionally considered related to Asian cultures and that are indicative of uncertainty avoidance were studied by Robertson and Hoffman (2000). The results of their study of 255 upper-level undergraduate business students indicated that these values were also commonplace in the U.S. In discussing the management implications of their study, they stated that “managers should focus on the value set of each individual when developing policies and determining who should deal with certain foreign trade partners.”

The results of a pilot study of oncologist and treatment acceptance decisions in a hospital in Amsterdam were presented by Huijter and Van Leeuwen (2000). While the doctors made their cancer treatment decisions based solely on the medical pros and cons, patients weighed the medical treatment advised in conjunction with their assessment of various personal factors. From the doctors’ perspective, refusal of treatment based on non-medical grounds was viewed with disapproval, and was often explained as related to the patient having some psychological problem. Patients, on the other hand, used a different “context” than the doctors. Their context included personal circumstances, belief systems, values, emotions, and attitudes. With “one of the principles of modern cancer care [being] that it should be responsive to the patients’ wishes and consistent with their values,” the researchers found it “striking” that the patients’ personal values were not considered by the doctors in their decision-making.

Several researchers have found a relationship between ethical decision-making and personal values. Singhapakdi and Vitell (1993) studied the ethical judgments and values of members of the American Marketing Association. They found that the values of self-respect and being well respected had high correlations with ethical judgment while the values of sense of accomplishment and excitement were predictors of unethical decisions. Finegan (1994) in a study of psychology students found the value of honesty related to morality judgments while the value of ambition predicted behavior. And, Fritzsche (1995) in a study of values of marketing managers and four ethical vignettes found a difference in the instrumental and terminal values of those who would select the ethical act from those who would select the unethical act.

This limited literature review indicates a number of relationships between personal values and decision-making. Posner and Schmidt (1984, 1992) demonstrated how the personal values of managers have remained stable over time and suggested that personal values may be determinants of which facts and options are considered by the decision-maker. Oliver (1999) also found the structure of values stable and suggested a difference in decision-making paradigms between personal and corporate values. Dunbar, et al. (2000) showed perceived group values as predictors of bias. Ravlin and Meglino (1981) found that work decisions were made consistent with personal values. Korsgaard, et al. (1996) identified a relationship between the value of concern for others and the cost/benefit analysis of decision options. Robertson and Hoffman (2000) found Asian cultural values to be commonplace in the U.S. and suggested that these values be considered in decisions involving foreign trade. Huijter and Van Leeuwen (2000) pointed out that oncologists need to consider patient values when choosing treatments. And, Singhapakdi and Vitell (1993), Finegan (1994), and Fritzsche (1995) all demonstrated a relationship between ethical decision-making and various personal values.

Discussion

Research has indicated a relationship between the acceptance, use, and effectiveness of decision support systems and various factors that can be identified as personal difference related. Models of decision-making also emphasize personal related factors such as sense-making, the selection of decision-making mode and images. In all three of the models cited, the personal values of the decision-maker are deemed important.

Research shows that a person's values are important in the study of choice behavior (Dawis, 1999). Based on the works by Rokeach (1968), Schwartz and Bilsky (1987), and Schwartz and Sagiv (1995), a number of personal values have been validated and shown to "form a system of compatible and conflicting motivations..." (Schwartz & Sagiv, 1995). Subsequent values research has indicated a number of relationships between personal values and decision-making. With "...the central purpose of DSS (being) to support and improve decision-making" (Turban, et al., 2007) and the values of the decision-maker shown as, in many instances, critical to the decision process, we suggest that further research into the relationship between decision support systems and values and value types be pursued. For example, questions such as these merit additional study: Can the consideration of values be used to improve the type of system offered to users with particular decision-making modes? Will the addition to DSS of a private and secure database that

includes personal values improve the intuition support of DSS? How do the personal values of the user affect the acceptance of a DSS? Can the consideration of values improve the trust in DSS assisted decisions? And, will the acceptance and use of DSS be improved by the consideration of various cultural value related factors? As values and value types are included in Decision Support Systems, further questions expanding their decision-making capabilities will result.

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